

DRAWINGS ATTACHED

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(54) APPARATUS AND A METHOD FOR MOULDING THE
WALL OF THE NECK OF AN EXTRUDED HOLLOW BODY

(71) I, WOLFRAM SCHIEMANN, a German citizen of, 714 Ludwigsburg, Eugen-Nagele Strasse 17, Germany do hereby declare the invention, for which I pray that a patent may be granted to me and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to an apparatus for use in forming a hollow article.

The neck of a container is subjected to a great variety of stresses irrespective of whether the neck has a screw cap fastening, a claw fastener as on jerry cans, or the like. These stresses apply, particularly but not exclusively, to wide-neck cans, bowls, vacuum flasks, etc. The neck of such a container is so wide that a hand can be inserted therein. The diameter of such a neck would usually be in the region of 7-10cm. In contrast to metal articles, those materials from which hollow bodies can be blow-moulded have substantially less rigidity. Therefore during stress there is a tendency for sections of the neck to be forced inwards so that the fastening is no longer satisfactory and perhaps even leaky.

As a remedial measure, it is known practice to provide a supporting ring in wide necks. In the case of necks having a smaller diameter, such supporting rings cannot be provided for reasons of space. These supporting rings are slightly tapered on the inside and fit over the front section of a mandrel for blow moulding. The mandrel is moved directly into the mould until the supporting ring is located to bear against the inner wall of the neck. The container is then blow-moulded, the mandrel withdrawn again, and the ring slips from its conical support. Since the ring is made of a plastics material, it can be welded to the still hot material of the container.

It is a disadvantage that the ring itself forms the inner wall of the neck so that all

liquids flow over it. In addition to its supporting properties, it must therefore have certain chemical properties in regard to food-stuffs, it should not be corroded by fuel, etc. Since it has to be made of a material which can be welded to the hot extrudate of the hollow body, the supporting ring can only be made of plastics material. However, plastics material has basically poorer rigidity than metal. Finally it is also a disadvantage that cracks can form on the dividing face between the reinforcing ring and the blow-moulded wall of the neck, which cracks can collect undesirable sediment and give rise to leakage.

Finally these containers can only be emptied with difficulty because the inner face of the reinforcing ring lies perpendicular to the direction of outflow and therefore causes turbulence.

In accordance with the invention there is provided apparatus for use in forming a hollow article comprising blow moulding means operable to form a tube into a moulding so as to leave an extension from a part arranged to provide a mouth for the article, and means, comprising an inflatable member, for returning said extension inwardly of the moulding and, by inflation of said member, forcing the extension against a surface within the moulding to provide increased wall thickness for a portion of said article, said inflatable member being withdrawable via said mouth when deflated.

By way of example, one embodiment of the invention will now be described with reference to the accompanying drawings, in which:—

Figure 1 shows a diagrammatic and partially cut-away cross-section, not true to scale, through a blow mould, an extruded tube and a mandrel in a first working cycle.

Figure 2 shows a view similar to Figure 1, with a second working cycle shown by continuous lines and a third working cycle

by broken lines.

Figure 3 shows a view of a fourth working cycle in continuous lines and a fifth working cycle in broken lines.

Figure 4 shows a section along the line IV-IV in Figure 3.

Figure 5 shows a sixth working cycle in continuous lines and a seventh working cycle in broken lines, and

Figure 6 shows a cross-section through the neck of a finished hollow body.

An extrusion head (not shown) is provided above the apparatus shown in Figure 1 and produces a tube 11 of hot thermoplastic material of circular cross-section. As is known practice in the blow moulding of hollow bodies, this tube 11 is not continuously produced. In effect a given length of extrudate is produced and then the blow-moulding operation commences when the tube is suspended. The material used for the tube 11 is conventional. The mould is likewise conventional and consists of two halves 12, 13. The halves 12, 13 can be moved horizontally away from and towards one another. When the halves are closed, their cavities 14, 16 combine into a form which is subsequently acquired by the hollow body. As is normal practice, threads 17, 18 are produced at the bottom of the die sections 12, 13. The preferred embodiment has a thread which is subsequently located on the outer face of the neck 19. However, the halves 12, 13 could also be shaped to form a neck such that a closure of the jerry can type can subsequently be secured at this point. Alternatively, some other type of neck could be formed. The only previous difference from prior art is that the tube 11 extends substantially further below the die sections, 12, 13.

A mandrel or sleeve 21 has a channel 22 for the passage of air and its free end comprises an outlet 23 for the air used in blow moulding. Slightly below the outlet 23 there are provided two circular plates 24 and 26 which are axially spaced from one another and extend perpendicular to the mandrel 21, said plates being rigidly attached to the mandrel 21 and having a diameter which is substantially smaller than the internal diameter of a circular reinforcing ring 27.

As shown in the drawings, the spacing between the plates 24, 26 is slightly greater than the height of the reinforcing ring 27. The outer circumference 28 of a pneumatically operated bubble 29 supports the reinforcing ring 27 which runs around the circumference and lies coaxially with the mandrel 21. The bubble can be filled with air from outside with the aid of a channel 31. Because of the plates 24, 26 the bubble expands perpendicular to the plane of the drawing in Figure 1 and holds the reinforcing

ring 27 rigid. The reinforcing ring 27 is mounted on the uninflated bubble 29 outside the apparatus and then brought into the position shown in Figure 1 in which the reinforcing ring 27 is on a level with the neck 19 to be subsequently formed and is located in such a position that its longitudinal axis lies in the dividing plane between the die sections 12, 13. The reinforcing ring 27 is made of metal and its circumference can be roughened. However, metal rings can also be used as obtained from an injection-moulding operation or cut off from conventional tubular sections.

The die sections 12, 13 are then moved towards one another so that the upper pressure faces 32 nip the tube 11 in a known manner and, as shown by the continuous lines in Figure 2, the tube is suspended in the cavity 14, 16. During this movement the threads 17, 18 also press the tube 11 in the corresponding section against the outer circumference 33 of the reinforcing ring 27 which is however not moved away from its position because its inner circumference 34 is always retained by the outer circumference 28 of the bubble 29. At the same time extrudate is also pressed into threads 17, 18 so that the thread is formed at this point. Air is then blown into the formed hollow space 36 with the aid of the mandrel 21 so that the tube bears against the inside of the die sections 12, 13. This is shown by the broken lines. Naturally the hollow body can have a different shape from that shown in the Figures. Its neck 19 can also be arranged on the side of the hollow body or staggered in some other way.

The bubble 29 is then deflated and returns to the outer form 37 shown by broken lines in Figure 2. The reinforcing ring 27 is therefore only retained by forces of adhesion or similar forces of the material which is compressed to form the neck 19 and is fully released from the bubble 29.

The bubble 29 could also be replaced by a rubber body, the diameter of which could be extended by moving the plates 24, 26 towards one another. In addition the reinforcing ring 27 could also be held by fingers which may be moved inwards and outwards radially to the mandrel 21. It would also be possible to use resilient or spring-like members which may be tensioned or released in a radial direction. There are a large number of equivalent means for ensuring that the reinforcing ring 27 is held during the blow moulding operation and then released. Electro magnetic devices would also be conceivable.

The mandrel 21 is then moved further into the hollow space 36 together with plates 24, 26 and the bubble 29 until the round face of the body 38 which is mushroom-shaped and rigidly connected to the mandrel

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21 lies on a level with the lower edge 39 of the tube 11. The numeral 39 indicates the lower edge of that section of the tube which is suspended below the threads 17, i.e. the section which is not compressed. Two pressure plates 41, 42 can be horizontally moved substantially perpendicular to the mandrel 21 in a similar manner to the die sections 12, 13. The guiding and operating means necessary for this purpose is not shown in the drawings. The pressure plates 41, 42 have open-edged recesses 43, 44 in the form of semi-circular segments which, after moving in the direction of the arrows 46, combine to form a circular recess, the diameter of which is equal to the diameter of the mandrel 21 plus the thickness of the extrudate. If the pressure plates 41, 42 are fully moved towards one another in the direction of the arrows 46, then their edges 47, 55 nip more tubular material and, as in the case of the top of a bag, the recesses 43, 44 force the tubular material above the body 38 against the shaft of the mandrel 21 to which the tubular material continues to adhere. In this connection folds or creases are certainly formed, but they are harmless and may be subsequently smoothed out.

The tube above the edge 39 could also be fastened as in the case of a bag in a different manner to that shown in the drawings, for example by a retaining means on the body 38. A ribbon-shaped loop, or the like, could be tightened to gather the extrudate to the mandrel and retain it like the top of a sack. If the pressure plates 41, 42 are located in the position shown in Figure 4, the edge 39 is slightly raised. Then the pressure plates 41, 42 are moved in the direction of the arrows 50 and returned to their starting positions and the mandrel 21 is moved further inwards into the hollow space 36 until a second bubble 48 is located in the neck 19. The bubble 48 can be alternately inflated or deflated from outside by a second channel (not shown). It is located between the body 38 and a plate 49, both of which are rigidly attached to the mandrel 21. As a result of the inward movement the tip 51 is turned inwards, as shown in Figure 5. Pressure is then exerted on the bubble 48 which tears open the tip 51 during its expansion. The tip 51 can also be slightly torn open to lighten the bubble 48, the body 38 and the mandrel 21 being moved into the hollow space 36 until the tip 51 is torn open. This is also facilitated by the spherical shape of the body 38. When the bubble 48 is expanded, as shown by the broken lines in Figure 5, the material 52 is pressed against the inner face 53 on the inner circumference 34 of the reinforcing ring 27 and against the inner section 54 above the neck 19 and firmly welded thereto while still hot. Therefore the operations have to follow one

another in sufficiently rapid succession. The dividing faces 56 between the same materials are shown in Figure 6. It can also be seen in Figure 6 that the material above the neck 19 is advantageously thickened thereby, and even doubled in thickness.

The dimensions are selected so that during the operation as shown in Figure 5 the outer face 58 is also simultaneously pressed by a pressure plate 57, which is rigidly secured perpendicular to the mandrel 21, so that flat surfaces are obtained at this point which are necessary for sealing purposes. The pressure plate 57 can also act as a stop and limit the path of insertion of the mandrel 21.

The bubble 48 is deflated again, returned to its original shape and the mandrel 21 fully withdrawn. The die sections 12, 13 open again and the finished hollow body can be ejected.

As can be seen in Figure 6, the reinforcing ring 27 is fully enclosed by thermoplastic material, is invisible from the outside and no gaps or cracks are formed which can be penetrated by a medium from outside. The neck 19 is smooth on its inner side and advantageously curved in the vicinity of the inner rim 59 for flow purposes. This is due to the fact that, when inflated, the bubble 48 does not assume an angular form, but always assumes rounded shapes. Therefore the tip 51 also subsequently leads almost directly into the tapering wall 61.

WHAT I CLAIM IS:—

1. Apparatus for use in forming a hollow article comprising blow moulding means operable to form a tube into a moulding so as to leave an extension from a part arranged to provide a mouth for the article, and means, comprising an inflatable member, for returning said extension inwardly of the moulding and, by inflation of said member, forcing the extension against a surface within the moulding to provide increased wall thickness for a portion of said article, said inflatable member being withdrawable via said mouth when deflated.

2. Apparatus as claimed in claim 1 wherein said returning means comprises a carrier member which carries the inflatable member and is reciprocable through said mouth, and gathering means arranged to gather a portion of the extension remote from said mouth so that the gathered portion can be carried into the moulding by inward movement of said carrier member, thereby to return the extension.

3. Apparatus as claimed in claim 2 wherein said gathering means comprises means for pressing the material of the extension inwardly towards the path of the carrier member.

4. Apparatus as claimed in claim 3 wherein said carrier member has a portion

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against which said material can be pressed by the gathering means.

5 Apparatus as claimed in any of claims 2 to 4 and further comprising a head member arranged to engage the gathered portion of the tube and to open it outwardly as the carrier member is moved into the moulding, thereby to facilitate operation of the inflatable member in forcing the gathered material against the moulding.

10 6. Apparatus as claimed in claim 5 wherein on the head member there is provided a retaining device for the gathered portion of the tube, which device retains the gathered portion in the same manner as the top of a sack.

7. Apparatus as claimed in any of claims 2 to 6 wherein said carrier member is an elongate member provided with a longitudinal passage for passage of gas during the blow-moulding operation.

8. Apparatus as claimed in claim 7 wherein said part is a neck part and said carrier member also carries a body which can be so located that a part of the tube to be incorporated in the neck part can be made to contact the body, or an element carried thereby, during the blow moulding operation.

9. Apparatus as claimed in claim 8 wherein said body is arranged to support a reinforcing ring for incorporation in said neck part and for contact by said part of the tube.

10. Apparatus as claimed in claim 8 or claim 9 wherein a dimension of said body transverse to said carrier member can be varied between a relatively large size for use during the blow moulding operation and a relatively small size to permit withdrawal of the body.

11. Apparatus as claimed in claim 10 wherein the body is resiliently compressible in the longitudinal direction of the carrier

member to cause the outer circumference of the body to be curved outwards.

12. Apparatus as claimed in claim 10 wherein the body comprises a further inflatable member.

13. Blow moulding apparatus substantially as hereinbefore described with reference to the accompanying drawings.

14. Blow moulding apparatus according to any preceding claim in combination with extruder apparatus for forming said tube.

15. A method of forming a hollow article comprising blow moulding a tube to form a moulding having an extension from a part arranged to provide a mouth for the article, returning said extension inwardly of the moulding and forcing it against a surface within the moulding to provide increased wall thickness for a portion of said article.

16. A method as claimed in claim 15 comprising the step of gathering a portion of the extension around a mandrel, moving the mandrel into the moulding and then inflating an inflatable member carried by the mandrel to force the material of the extension against said internal surface.

17. A method as claimed in claim 15 or claim 16 wherein said part is a neck part, the method including the step of locating a reinforcing ring within a part of the tube to be incorporated in the neck part and causing said part of the tube to contact the reinforcing ring during the blow moulding operation.

18. A method of forming a hollow article substantially as hereinbefore described with reference to the accompanying drawings.

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1,339,335 COMPLETE SPECIFICATION

4 SHEETS

*This drawing is a reproduction of
the Original on a reduced scale.*

SHEET 1

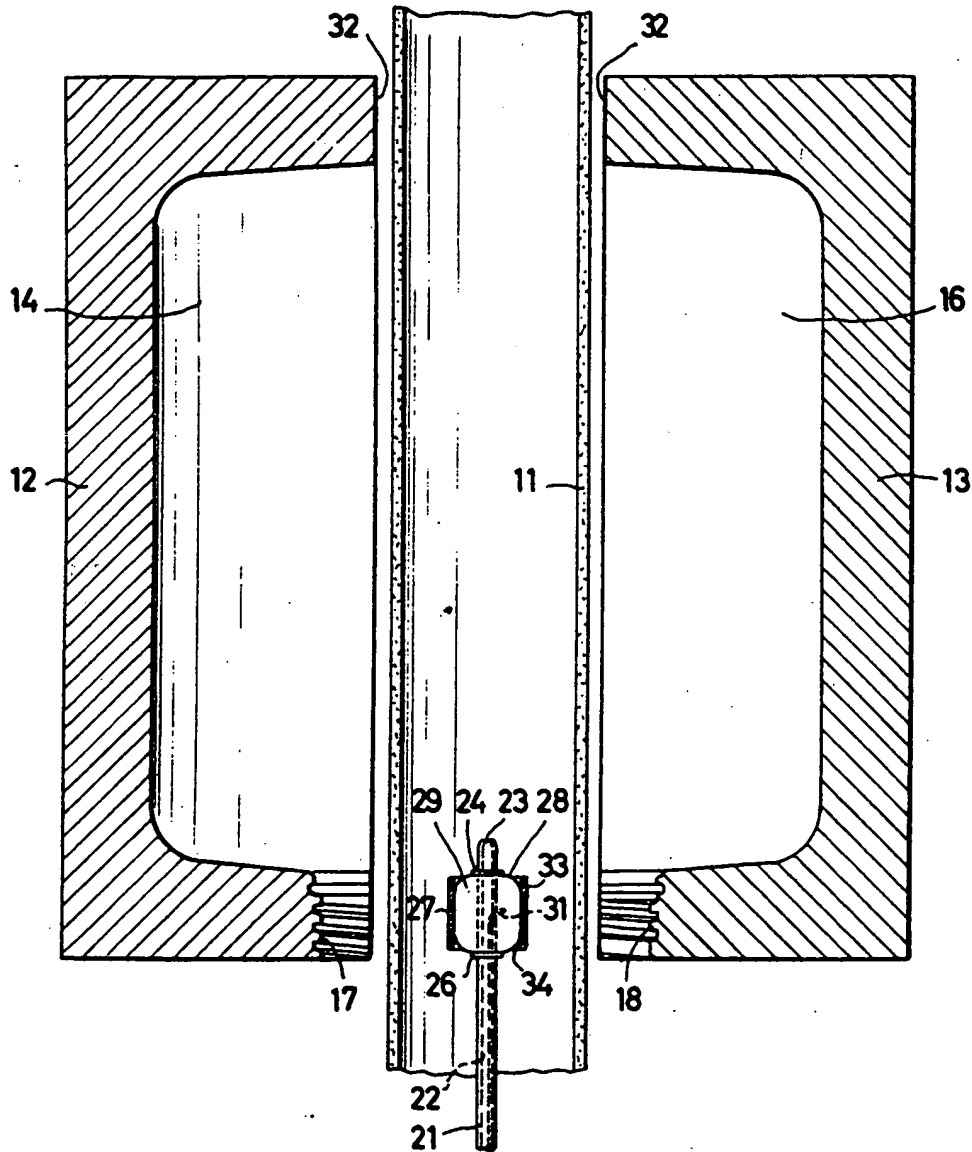


Fig. 1

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COMPLETE SPECIFICATION
This drawing is a reproduction of
the Original on a reduced scale.
SHEET 2

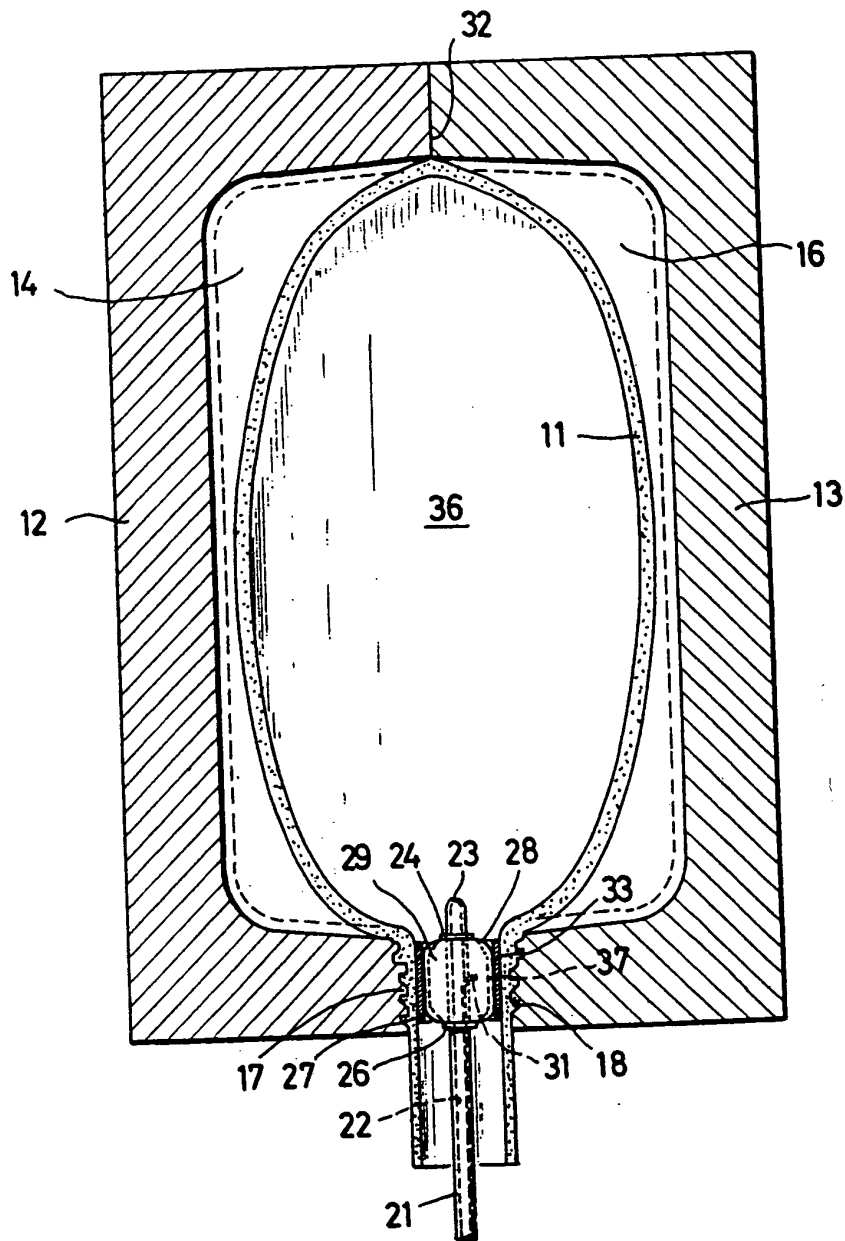


Fig. 2

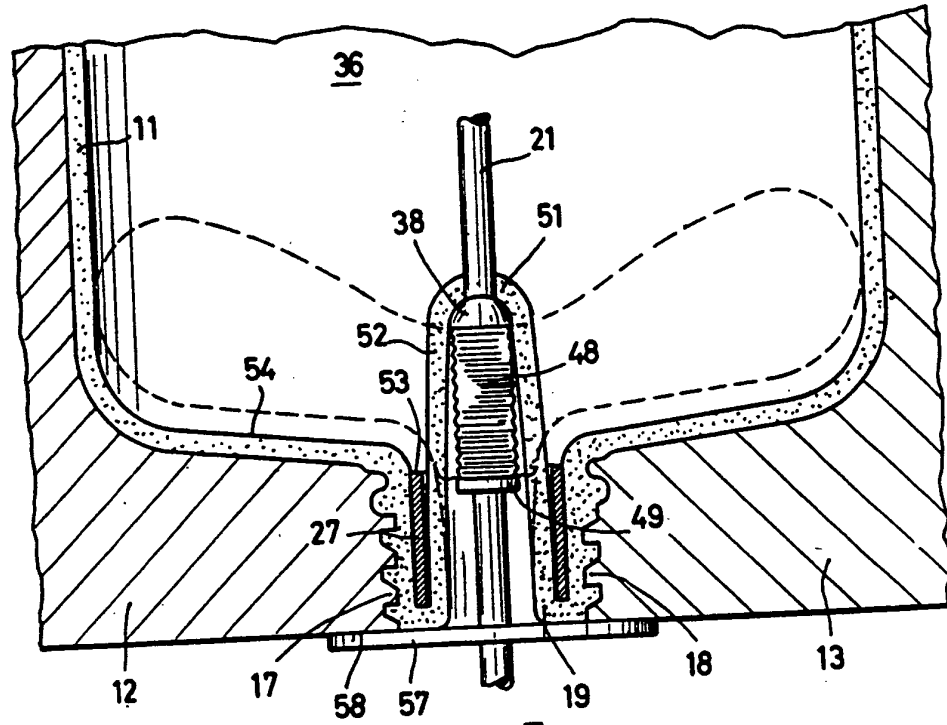


Fig. 5

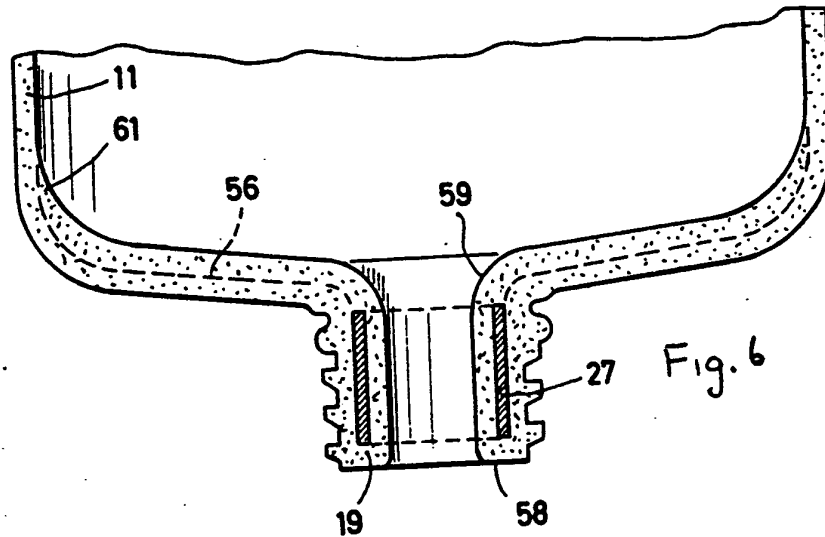


Fig. 6